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| EXAMINER |
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ABRAHAM, ELSABETH

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| ART UNIT | PAPER NUMBER |
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1709

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
|--|------------|---------------|
| 3 MONTHS | 04/20/2007 | PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

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|------------------------------|--------------------------------------|--------------------------------------|--|
| Office Action Summary | Application No. 10/791,259 | Applicant(s) TABERY ET AL. | |
| | Examiner Elsabeth Abraham | Art Unit 1709 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
 4a) Of the above claim(s) 19 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☒ Claim(s) 1-20 are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03/02/04 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date <u>03/02/04</u> . | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-18 are drawn to method of exposing a resist, classified in class 430, subclass 322.
 - II. Claims 19 and 20 are, drawn to lithographic system, classified in class 355, subclass 67. The inventions are distinct, each from the other because of the following reasons:
2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used in another and materially different process, such as an immersion lithography process.
3. Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions require a different field of search (see MPEP § 808.02), restriction for examination purposes as indicated is proper.
4. During a telephone conversation with Jonathan A. Platt on 02/06/07 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-18. Affirmation of this election must be made by applicant in replying to this Office action.

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Claims 19 and 20 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention. Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions have acquired a separate status in the art due to their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Specification

6. The disclosure is objected to because of the following informalities:

Fig. 1 and Fig. 4 have been interchangeably used in the specification. For Example in paragraph [0006], Fig 1 should read Fig 4., because system 100 is in Fig 4.

Drawings

7. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: in paragraph [0034], major axis 32 and minor axis 34 referenced are not shown in Fig 8. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement-drawing sheet should include all of the figures appearing on the

immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

9. Claims 15-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term average angle of incidence in claim 15 is a relative term, which renders the claim indefinite. The term average angle of incidence is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. For examination purposes the claim has been treated as having an angle of incidence.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claims 1, 2, 4-12, and 14-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Tanitsu et al. (2002/0085276)

With respect to claim 1, Tanitsu discloses a method for exposing a resist (Fig 1), comprising:

Providing radiation (1) having a cross-section shape (Fig 5) that is asymmetric(elliptical annular shape) (Page 2, Paragraph [0013], [0125]); reflecting the asymmetric radiation off a reflective reticle (M); and directing the asymmetric radiation to the resist(W). (Page 23, Paragraph [0251])

With respect to claim 2, Tanitsu further discloses radiation that has a greater range of angle incidence in a first direction than in a second direction that is perpendicular to the first direction. (Page 2, Paragraph [0014]).

With respect to claim 4, Tanitsu also discloses providing asymmetric radiation that has an elliptical shape (Fig 5A) in phase space. (Page 9, Paragraph [0125])

With regards to claim 5, Tanitsu discloses asymmetric radiation that has an elliptical ring (annular) shape (Fig 5B) in phase space. (Paragraph [0125])

With regards to claim 6, Tanitsu discloses elliptical ring shape has a substantially uniform (Fig 5D) ring width. (Page 1, Paragraph [0005])

With regards to claim 7, Tanitsu discloses an elliptical ring shape that has a non-uniform (Fig 5B) ring width.

With regards to claim 8, Tanitsu also discloses transforming symmetric radiation to the asymmetric radiation. (Page 2, Paragraph [0013])

With regards to claim 9, Tanitsu discloses where the transforming includes reflecting the symmetric radiation of a mirror (3) to produce the asymmetric radiation. (Page 5, Paragraph [0095])

With regard to claim 10, Tanitsu discloses, reflecting off the mirror includes reflecting off a fly's eye mirror (6) having a plurality of facets. (Page 5, Paragraph [0095])

With regards to claim 11, Tanitsu discloses, the reflecting off the mirror includes reflecting off a fixed mirror (3).

With regards to claim 12, Tanitsu discloses the transforming includes passing the radiation through one or more lenses (2) to produce the asymmetric radiation.

With regards to claim 14, Tanitsu discloses the symmetric radiation includes non-coherent (excimer) radiation at 248nm from a laser source. (Page 6, Paragraph [0100])

With regards to claim 15 as interpreted in paragraph 10 above, Tanitsu discloses as reflecting off the reticle includes reflecting the asymmetric radiation at an angle of incidence (Page 2, Paragraph [0014]).

With regards to claim 16, Tanitsu discloses changing the asymmetry of the asymmetric radiation in response to changes in the average angle of incidence. (Page 1, Paragraph [0011])

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanitsu et al. (2002/0085276) as applied to claim 2 and further in view of Amara (6,731,380).

With regards to claim 3, Tanitsu discloses changing the aspect ratio of an incoming light beam in order to change an angle of incidence of the incoming light beam in a predetermined direction. (Page 1, [0011]).

However, Tanitsu fails to teach the ratio of the range of the angle incidence between the first direction and the second direction that is greater than 1.

Amara et al. teaches various properties of optical devices such as the laser beams. Amara et al. teaches that a measurement of radiation beam is performed preferably at an incident angle greater than 10 degrees to the sample surface for better resolution purposes. For measurements in the transmission mode, the incident angle must lead to an internal angle on the second interface smaller than the total internal reflection angle (Paragraph, [0026]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have an angle of incidence that is greater in first direction than the second

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of an incoming light beam, as taught by Amara in the method of Tanitsu in order to achieve better resolution.

14. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanitsu as applied in claims 1 and 8 and further in view of Takai et al. (20050225752).

With regards to claim 13, Tanitsu discloses a light beam-converting element such as a diffraction optical element such as a lens (2) are used to convert a light beam from a light source into a light beam having a quadrupole or annular (asymmetric) configuration (Page 5, [0095]).

However, Tanitsu fails to teach transforming radiation through one or more slits to produce asymmetric radiation.

Takai et al. discloses optical elements used to transform the shape of a light from a source. The effectiveness of changing a light from a source using, a transformation optical axis such as lens or slit for optical axis transformation of (asymmetric) radiation (Page 10, Paragraph [0092]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a slit in place of the lens optical element of Tanitsu, since it is merely the selection of functionally equivalent optical elements known to change the shape of a light, as taught by Takai and one would have a reasonable expectation of success in doing so.

15. Claims 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanitsu et al. (2002/0085276) as applied to claim 1, further in view of Kinney et al. (US 2004/0012775)

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With regards to claim 17, Tanitsu discloses an aspect ratio-changing element for changing the aspect ratio of the incoming light beam, in order to change the angle of incidence of the incoming light beam (Page 5, Paragraph [0095]).

However, Tanitsu fails to teach the average angle of incidence is between about 2 degrees and about 8 degrees.

Kinney et al. (US 2004/0012775) discloses an optical inspection module wherein a light beam illuminating substrate that is oriented to form a grazing angle of incidence (62).

Kinney teaches a grazing angle of incidence being between zero degrees and ten degrees from a vector parallel to the upper surface of substrate (Paragraph [0053]).

Kinney further teaches a grazing angle of incidence allows an entire wafer surface to be illuminated in order to minimize the effects of light, and it is preferred that the illuminating beam be shaped so that only the substrate surface is illuminated. For example, in the case of 300-millimeter semiconductor wafer being illuminated at a 5-degree angle of angle of incidence to the surface. The light can have a cross-section in the shape of an ellipse with dimensions of approximately 300 millimeters by 26 millimeters, corresponding to an aspect ratio of 11.5:1 (Paragraph [0054]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a small angle of incidence as disclosed in Kenny et al., in the method of Tanitsu in order to illuminate an entire wafer surface and to minimize the effects of light.

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16. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanitsu et al. (2002/0085276) as applied to claim 1 and further in view of Felter et al. (5,989,776).

With regards to claim 18, Tanitsu discloses laser light source for supplying the light having a wavelength of, for example, 248 nm (KrF) or 193 nm (ArF) as a light source (1) for supplying the exposure light beam (illumination light beam).

Tanitsu fails to teach the asymmetric radiation includes extreme ultraviolet radiation having a wavelength between about 3 nm and about 70 nm.

Felter et al. teaches that it is possible to produce EUV with wavelength of 13 nm for lithography application (Col 3, lines 25-35) in order to achieve better resolution. In order to increase resolution beyond the limits inherent to optical photolithography systems, one has to use shorter wavelength radiation such as EUV as evidence by the teachings of Felter.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use 13 nm EUV radiation taught by Felter et al. in the method of Tanitsu in order to increase the resolution in lithographic process.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elisabeth Abraham whose telephone number is 571 272 9803. The examiner can normally be reached on Mon-Fri 7:30a.m-5:00p.m EST.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571 272 1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

EA


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SUPERVISORY PATENT EXAMINER